# Jerusalem Science Contest 2008-2009 -חידון המדע הירושלמי תשס"ח
# Electromagnetic and Ionizing radiation
# Exam 11 — Chapter 34 -Nuclear Fission and Fusion

**Name:**_____ **Date:**_____

**Raw Score:**_____ **Percentage Score:**_____%

**Proctor for this Examinaton:**_____ **Form:**_____

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

1) Approximately how much plutonium is required to make an atomic bomb, if no tamper is used?
A) 10 kg B) 500 g C) 7.5 kg D) 1.5 kg E) 5 kg

2) The explosive yield of the atomic bombs droped on Hiroshima and Nagasaki, Japan were equivalent to about 15 kilotons of TNT. The largest H–bomb ever exploded has a yield of about
A) 50 megatons. B) 50 kilotons. C) 1 megaton. D) 500 kilotons. E) 20 megatons.

3) At what temperature does a fusion reaction produce enough energy to be self–sustaining?
A) 35 million K
B) 1 million K
C) 350 million K
D) 1 billion K
E) 10 million K

4) The percentage of U–235 in reactor grade uranium fuel is approximately
A) 90%. B) 10%. C) 1.0%. D) 2.5%. E) 0.5%.

5) The individual generally credited as being the "father of the hydrogen bomb" is
A) Robert Openheimer
B) Alber Einstein
C) Edward Teller
D) Enrico Fermi
E) Niels Bohr

6) In a nuclear reaction , mass is converted to energy. The mass equal to the nuclear binding energy released is known as the
A) Fermi constant
B) mass deficit
C) mass defect
D) Einstein factor
E) mass equivalence

7) Fusion reactions are more efficient than fission reactions. The amount of mass converted to energy in a fission reaction is about 0.1%. In a fusion reaction it is about
A) 0.5%. B) 50%. C) 0.7%. D) 5%. E) 0.25%.

8) The force that must be overcome in order for fission to occur is

A) the strong force.
B) the electromagnetic force.
C) the gravitational force.
D) the weak force.
E) all of the preceding must be overcome

9) Which of the following isotopes could be used to make a nuclear weapon (without further transmutation) ?

A) Th–232
B) Pu–239
C) U–238
D) all of the preceding
E) none of the preceding

10) The material used as fuel for fusion experiments today is

A) deuterium
B) lithium deuteride
C) tritium
D) a mixture or deuterium and tritium
E) lithium hydride

11) The percentage of U–235 in weapons grade uranium is about

A) 50%. B) 90%. C) 65%. D) 25%. E) 10%.

12) The uranium compound that is used to separate U–235 from U–238 is

A) $UF_6$.
B) $UO_3$.
C) $UO_2$.
D) $UO_2(NO_3)_2$.
E) none of the preceding.

13) Which of the following reactions will result in the production of neutrons?

A) irradiating uranium –235 with alpha particles from americium–241
B) irradiating beryllium–9 with alpha particles from polonium–209
C) irradiating lead–206 with beta particles from Cs–137
D) all of the preceding
E) none of the preceding.

14) U–238 is converted into a fissile material in what kind of a nuclear reactor?

A) fission reactor
B) breeder reactor
C) fusion reactor
D) heavy water reactor
E) none of the preceding

15) The measure of how efficiently the nucleus of an isotope of any element will either absorb or scatter a neutron upon collision with it is called the

A) nuclear absorption coefficient
B) neutron cross section
C) nuclear collision constant
D) neutron effective area
E) none of the preceding

16) In addition to mass, geometry is important in determining whether or not sustained fission will occur. For objects of the same mass

A) surface area to volume is not important, only the shape.
B) a low surface area to volume ratio is more favorable for sustained fision.
C) neither a high nor a low surface area to volume ratio is favorable, but an intermediate value is favorable.
D) a high surface area to volume ratio is more favorable for sustained fission.
E) none of the preceding.

17) Neutron bombardment of U–238 resulted in the production of the first man–made transuranium element. Which element is it?

A) americium–239
B) plutonium–239
C) neptunium–239
D) protactinium–239
E) none of the preceding

18) Which of the following fusion reactions will produce the greatest energy?

A) fusion of protium and tritium
B) fusion of deuterium and tritium
C) fusion of protium and deuterium
D) fusion of deuterium and deuterium
E) none of the preceding – they all have the same yield.

19) Which of the following are fissionable isotopes of the element uranium?

A) U–235
B) U–233
C) U–238
D) all of the preceding
E) none of the preceding

20) The amount of U–235 present in naturally occuring uranium is about

A) 0.7% B) 5.0% C) 1.6% D) 2.5% E) 0.05%

21) How many neutrons are released by the fissioning of one atom of U–235 into an atom of Kr–91 and Ba–142? (Kr and Ba have atomic numbers of 36 and 56, respectively; U has an atomic number of 92).

A) two B) three C) one D) five E) four

22) Which of the following methods have been used to obtain enriched uranium?
A) fractional crystallization
B) liquid chromatography
C) electrophoresis
D) fractional distillation
E) gaseous diffusion or effusion

23) Fast neutrons can be slowed to thermal neutrons by passing them through certain materials known as
A) converters.
B) moderators.
C) inverters.
D) modulators.
E) none of the preceding.

24) The "trigger" for a hydrogen bomb is a
A) thermite reaction
B) atomic bomb
C) pulsed nanosecond laser
D) plasma discharge
E) none of the preceding

25) The first man–made self–sustained nuclear chain reaction was initiated at
A) MIT.
B) Stanford University.
C) the University of Chicago.
D) the University of California at Berkeley.
E) the Trinity site, Alamogordo, NM.